



**Illinois State Water Survey Division**  
**SURFACE WATER SECTION**

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SWS Contract Report 475

**FLOODPLAIN CONSIDERATIONS IN SITE EVALUATION  
FOR THE SUPERCONDUCTING SUPER COLLIDER  
IN NORTHEASTERN ILLINOIS**

*by G. Michael Bender*

Prepared for the  
Illinois Department of Energy and Natural Resources

Champaign, Illinois

October 1989



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# **FLOODPLAIN CONSIDERATIONS IN SITE EVALUATION FOR THE SUPERCONDUCTING SUPER COLLIDER IN NORTHEASTERN ILLINOIS**

**by G. Michael Bender**

Flood hazard identification was an aspect of the site evaluation process for locating the Superconducting Super Collider beneath the land surface of northeastern Illinois. Planning for the location of surface buildings and facilities had to comply with floodplain management regulations. The Illinois State Water Survey produced the first comprehensive map of floodplains for the 36-township study region. The map information was placed with other data sets on the Geographic Information System of the Department of Energy and Natural Resources. ISWS also provided calculations of streamflow characteristics at points where area streams intersected the selected geographic configuration for the SSC. This report describes these products in detail, compares them to existing maps and related information, and discusses their potential uses and limitations.

## **INTRODUCTION**

When northeastern Illinois became a candidate for the Superconducting Super Collider (SSC), the project's potential environmental impacts were evaluated for its effects on floodplains. Although the project was to be constructed in underground tunnels, the locations of surface buildings and facilities, access roads, and disposal sites for excavated material would have to be chosen in compliance with sound floodplain management practices. The fundamental tenets of floodplain management discourage new development and redevelopment in floodplains, especially for congested streams in dense urban areas. Management tenets are also intended to ensure that any allowed development is not at flood risk itself and does not cause increased risk to existing properties. The communities and counties in the 36-township study region for the SSC project participate in the National Flood Insurance Program (NFIP). Through ordinances required by this program, the communities and counties practice floodplain management by carefully controlling development and other activities in flood-hazard areas. The state supervises community and county efforts in floodplain management and exerts authority beyond local capability over critical portions of floodplains.

Despite the activity of local and state authorities in floodplain management, no comprehensive regional map of floodplains and flood-hazard areas existed for the study region. Such a map was produced by the Illinois State Water Survey (ISWS) to assist in evaluating

plans for siting the SSC. When the best site had been chosen, critical points were identified in the study region for which information was inadequate for sound floodplain management decisions. At these points, additional data were collected and calculations made to prepare for anticipated detailed studies. These calculations and the regional floodplain map have inherent value even without the construction of the SSC. The purpose of this report is to describe these products and explain their value.

### **Acknowledgements**

Dr. Krishan P. Singh of the Surface Water Section directed the Water Survey's contribution of information and analyses for the effort to bring the SSC to Illinois. Portions of this report were drawn from progress reports on SSC-related tasks written by Sally M. Broeren and Ganapathi Ramamurthy. Ms. Broeren performed most of the work relating to the development of the floodplain coverage on the GIS, and Mr. Ramamurthy produced the estimates of streamflow characteristics in the study region. Figures were prepared by Linda J. Riggin. Kathleen J. Brown typed and formatted the manuscript, and Laurie McCarthy edited and produced the report.

## **BACKGROUND**

The Federal Emergency Management Agency (FEMA) has produced the most extensive floodplain maps available for northeastern Illinois. The maps are the result of community and county participation in the NFIP, which is run by FEMA. The purpose of the NFIP is to promote sound floodplain management at the local level by encouraging control of new development and requiring flood insurance for existing structures in identified flood-hazard areas. The areas mapped as floodplains correspond to those expected to be inundated during the 100-year flood; i.e., the flood that theoretically has a 1% chance of occurring any year. These maps generally represent the best available data on flood-hazard areas in the region. Most FEMA maps are the products of Flood Insurance Studies (FISs) for individual communities and for unincorporated areas of single counties. In an FIS, all significant sources of flooding in the study area are identified. Some are selected for detailed study, and the rest are reserved for determinations by approximate methods.

Detailed study refers to a full hydrologic and hydraulic analysis of a stream. Flood flows of different frequencies are calculated for several points along the stream. They are based on analysis of available historical flow records and simulation modeling of flow response to different rainfall events. The flows resulting from the hydrologic study are then used in a standard flood hydraulics analysis, which routes the flows through a representation of the stream as a series of reaches of measured length, cross section, and surface roughness. Points of flow restriction, such as bridges and culverts, are identified and carefully described. The result of the hydraulic analysis is a flood profile of water-surface elevations throughout the length of the stream. The elevations of the profile are then mapped onto the best available topographic maps to delineate the extent of the floodplain.

Study by approximate methods refers to the combination of relatively simple calculations, examination of any records of prior floods, and on-site observations to sketch the approximate extent of the floodplain. Usually there are no calculations for 100-year flood flows or elevations. Some communities and counties have no FIS and no detailed study; if not based on some other type of study, all of their floodplains are essentially approximate.

The resulting depiction of floodplains determined by detailed and approximate methods is called the Flood Insurance Rate Map (FIRM). For each community or county, the FIRM consists of one or more panels that illustrate roads and railroads, corporate boundaries, and section and township lines; floodplains are shown as shaded areas surrounding streams. The FIRMs are mapped at scales ranging from 1:4,800 to 1:24,000. Where detailed studies have been carried out, indications of flood elevations are also noted on the shaded floodplain areas.

Two characteristics of the FIRMs make them awkward to use in regional planning. First, the FIRM for a community shows only the area within the corporate limits at the time of

the FIS. The FIRM for a county covers only the unincorporated areas. Although there was a strong coordination effort among the various studies, inconsistencies remain in the representation of floodplains for streams passing from one community or county into another. Several incorporated areas are not represented on any FIRMs because their annexations fell between the times of the community and county FISs. Second, the relatively large scale chosen for most FIRMs necessitates the use of many map panels to cover a study area the size of the SSC project. The variety of scales used in printing the FIRMs makes it difficult to match and compare maps from adjacent jurisdictions. Countywide mapping, which depicts floodplains throughout the county and incorporated areas without regard for corporate limits, is now being advanced by FEMA; but no such mapping yet exists for the portion of northeastern Illinois that was under consideration for the SSC.



## FLOODPLAIN MAP

A composite map of hydrologic information was prepared for the study region in northeastern Illinois. The region (figure 1) covers all or parts of Cook, DeKalb, DuPage, Kane, Kendall, and Will Counties and includes 35 incorporated areas. Rectangular township and range survey lines outlining the study area are the north line of Township 42 North (T42N); the south line of T37N; the west line of Range 4 East (R4E); and the east line of R9E, all relative to the Third Principal Meridian and Centralis Base Line. This area constitutes a total of 36 townships covering 1,296 square miles. Major river basins in the study **area are the** Fox River, the DuPage River, and the South Branch of the Kishwaukee River (tributary to the Kishwaukee River and the Rock River).

The 100-year floodplain boundaries shown on the FIRMs were drafted on vellum overlying maps from the U.S. Geological Survey's (USGS) 7.5-minute topographic series. Floodplain boundaries were checked for conformity with elevation contours. Thirty USGS topographic maps at a scale of 1:24,000 were required to cover the study areas shown in figure 1. Floodplains narrower than 200 feet in width could not be drawn to exact scale and were shown at the maximum 200 feet width. The completed series of 7.5-minute vellum overlays shows the locations of the river and stream centerlines, 100-year floodplain boundaries, low-lying areas subject to flooding, lakes outside the floodplains, and potential reservoir sites. Lake locations were obtained directly from the USGS topographic maps. Potential reservoir sites correspond to those in "Potential Surface Water Reservoirs of North Central Illinois," by J. H. Dawes and M. L. Terstriep (Illinois State Water Survey Report of Investigation 56, Champaign, Illinois, 1966).

Locations of rivers, floodplain boundaries, lakes, and potential reservoirs were transferred from the vellum overlays and 7.5-minute maps to digitized Lambert coordinates. Coordinate reference points were taken from the USGS topographic maps. The final map (figure 2) features stream centerlines, 100-year floodplains, existing lakes outside the floodplains, and potential reservoir sites in the study area. Stream centerlines denote the approximate location of the center of intermittent and perennial streams within the study area. Only streams within the 100-year floodplain are included. The 100-year floodplain is the approximate areal region that would be inundated during a flood equal in magnitude to the 100-year event. Lakes within the bounds of the floodplain are not explicitly outlined. Existing lakes external to the floodplain are shown. Potential reservoir sites are possible locations for development of water resources.

The hydrologic information portrayed in figure 2 was developed from a multitude of other data sets on the Geographic Information System (GIS) established and maintained by the Illinois Department of Energy and Natural Resources (DENR). The GIS is maintained on a

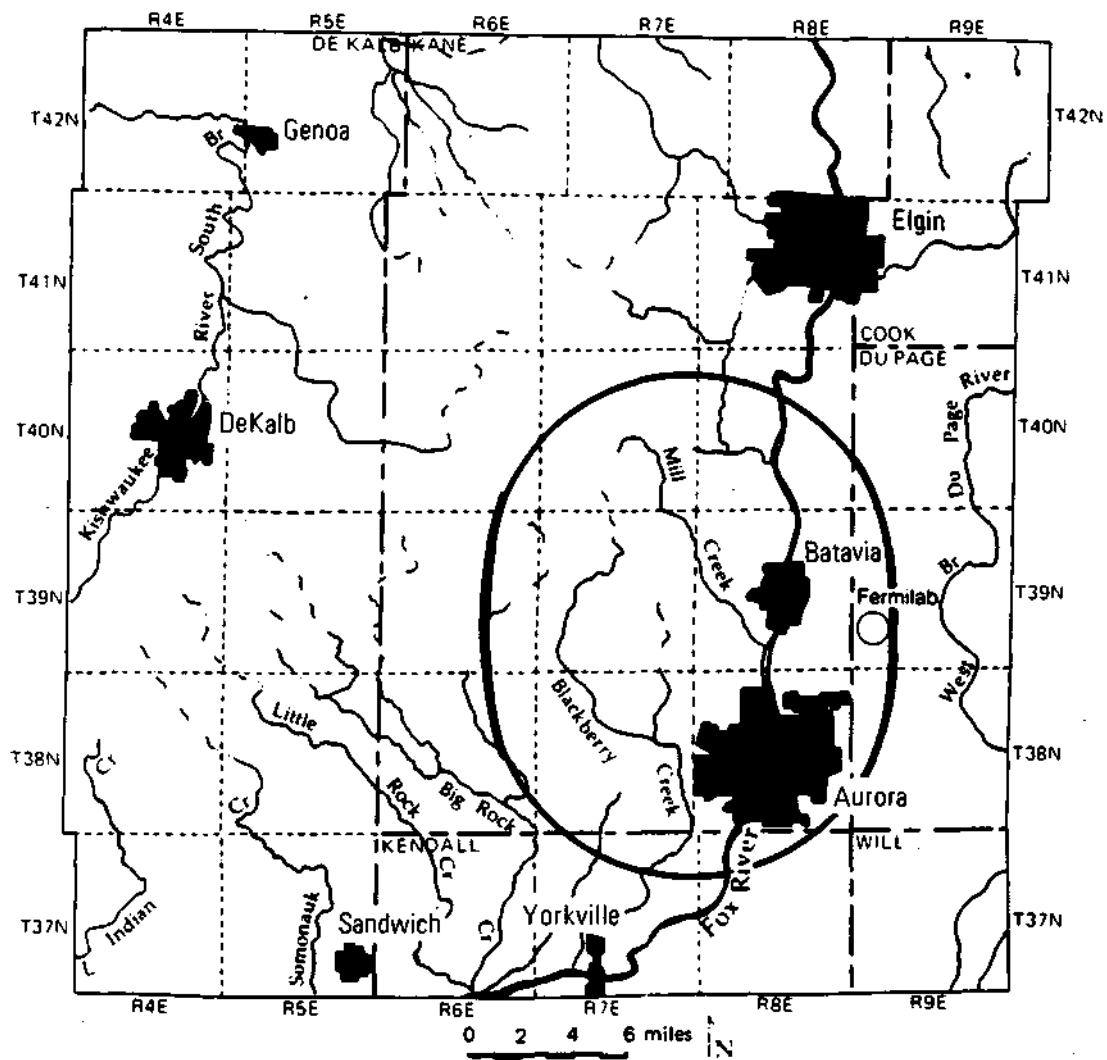


Figure 1. SSC 36-township study region

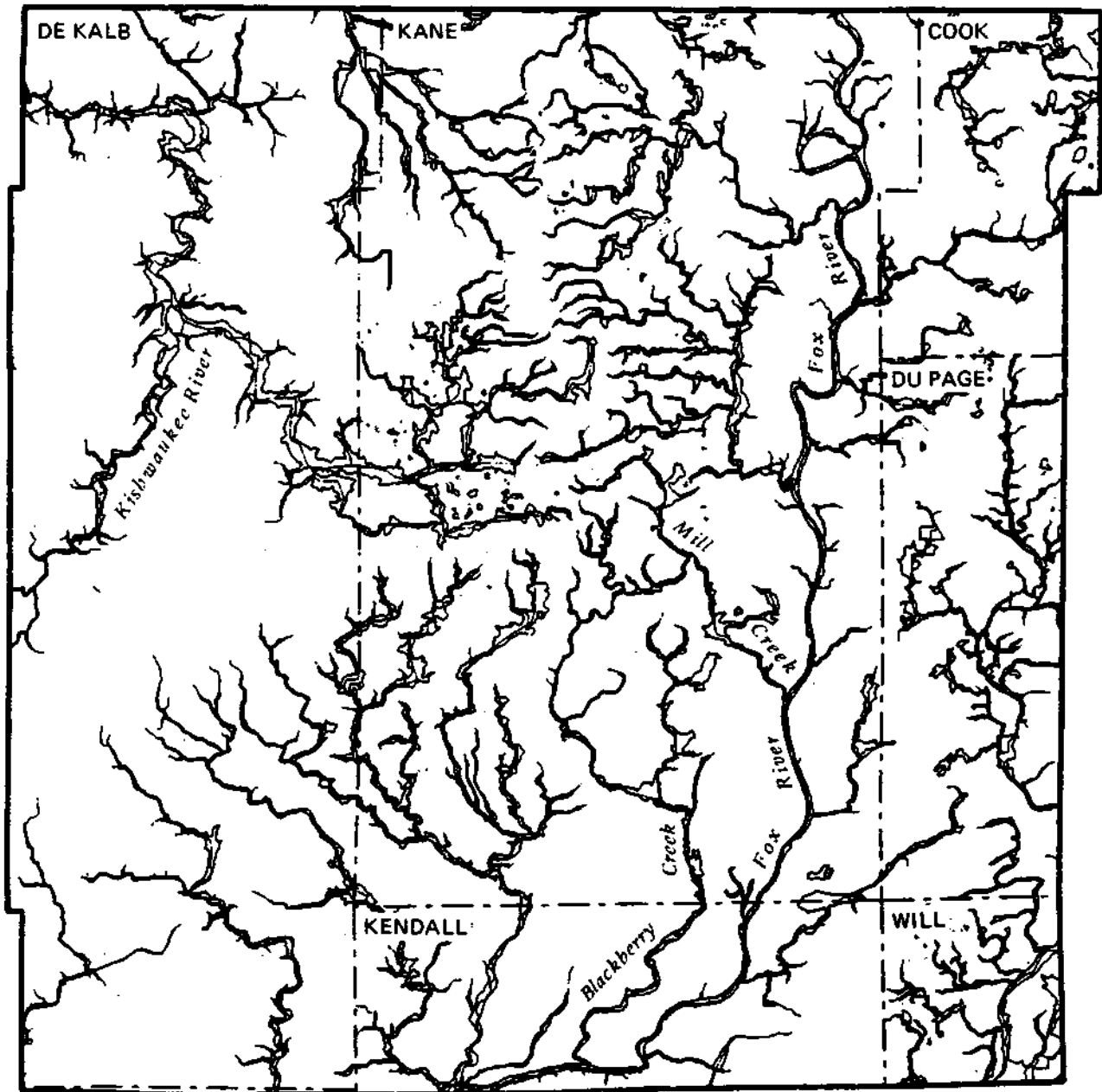


Figure 2. GIS floodplain coverage for study region

PRIME computer at the Illinois Natural History Survey in Champaign. All five divisions of DENR, including ISWS, contribute frequently to the GIS, so that the number, size, and complexity of its databases are updated and expanded continually. Data are entered, modified, and retrieved using ARC/INFO geographic mapping software. The digitizing process was structured to facilitate information retrieval for various plotting formats. Potential reservoir sites and existing lakes, for example, may be shown or easily excluded; floodplains may be shaded, depicted by line boundaries, or described using other options. The digitized hydrologic information is compatible with any other database in Lambert coordinates for simultaneous machine plotting. The floodplain database developed is a comprehensive compilation of available information. The digitized data can be plotted in various formats for versatility in presentation and to correspond to other geographic information for coordinated analyses.

## 100-YEAR FLOOD FLOWS

When the best apparent location and configuration for the SSC had been selected within the study region, a map was generated upon which area streams could be seen to intersect with the SSC ring in 23 locations (figure 3). The streams ranged from the Fox River down to drainage ditches, unnamed tributaries, and creeks. For each of the 23 points, 100-year flood flows ( $Q_{100}$ s) were calculated, along with several other flow-parameter values.  $Q_{100}$ s were determined with the thought that SSC ring facilities, structures, or access paths might infringe on the floodplains of the streams. The  $Q_{100}$  calculations are the first step in making detailed determinations of flood elevations, depths, velocities, and extents.

Table 1 contains descriptions, drainage areas, channel lengths, and expected 2-, 25-, 50-, and 100-year floods at the 23 points. Flood frequency estimates were obtained from the regression equations shown below. The equations were developed from readily available information on drainage area A and channel length L. They are adequate to represent streams with small- to medium-sized drainage areas in the vicinity of the ring.

$$\log Q_2 = 1.743 + 1.087 \log A - 0.626 \log L \quad (1)$$

$$\log Q_{25} = 2.172 + 1.302 \log A - 0.992 \log L \quad (2)$$

$$\log Q_{50} = 2.235 + 1.336 \log A - 1.047 \log L \quad (3)$$

$$\log Q_{100} = 2.291 + 1.361 \log A - 1.092 \log L \quad (4)$$

The regression equations were not applied to the two sites on the main stem of the Fox River. The values shown for them in table 1 were estimated from historical flow records at other sites on the river.

During the time that the Flood Insurance Studies were being conducted, ISWS instituted and maintained a repository of approved 100-year flood flows. The approval of submitted values was a two-stage process, in which ISWS reviewed the submissions and recommended that actual approval be granted or withheld by the Illinois Department of Transportation, Division of Water Resources (IDOT-DOWR). The purposes of the process were to ensure the use of reasonable flow values, to prevent repetitious calculation of flows at any site, and to foster consistency and continuity among various studies along individual streams. This repository is now housed and maintained by IDOT-DOWR alone.

Figure 3 and table 2 contain  $Q_{100}$  values and brief descriptions of other points on streams near the SSC ring that are already entered in the repository. The  $Q_{100}$  values produced for the 23 identified intersections have been checked for consistency with existing repository values and submitted to IDOT-DOWR for approval and inclusion in the repository. If approved, they will become usable reference flows for future flood studies on these streams.

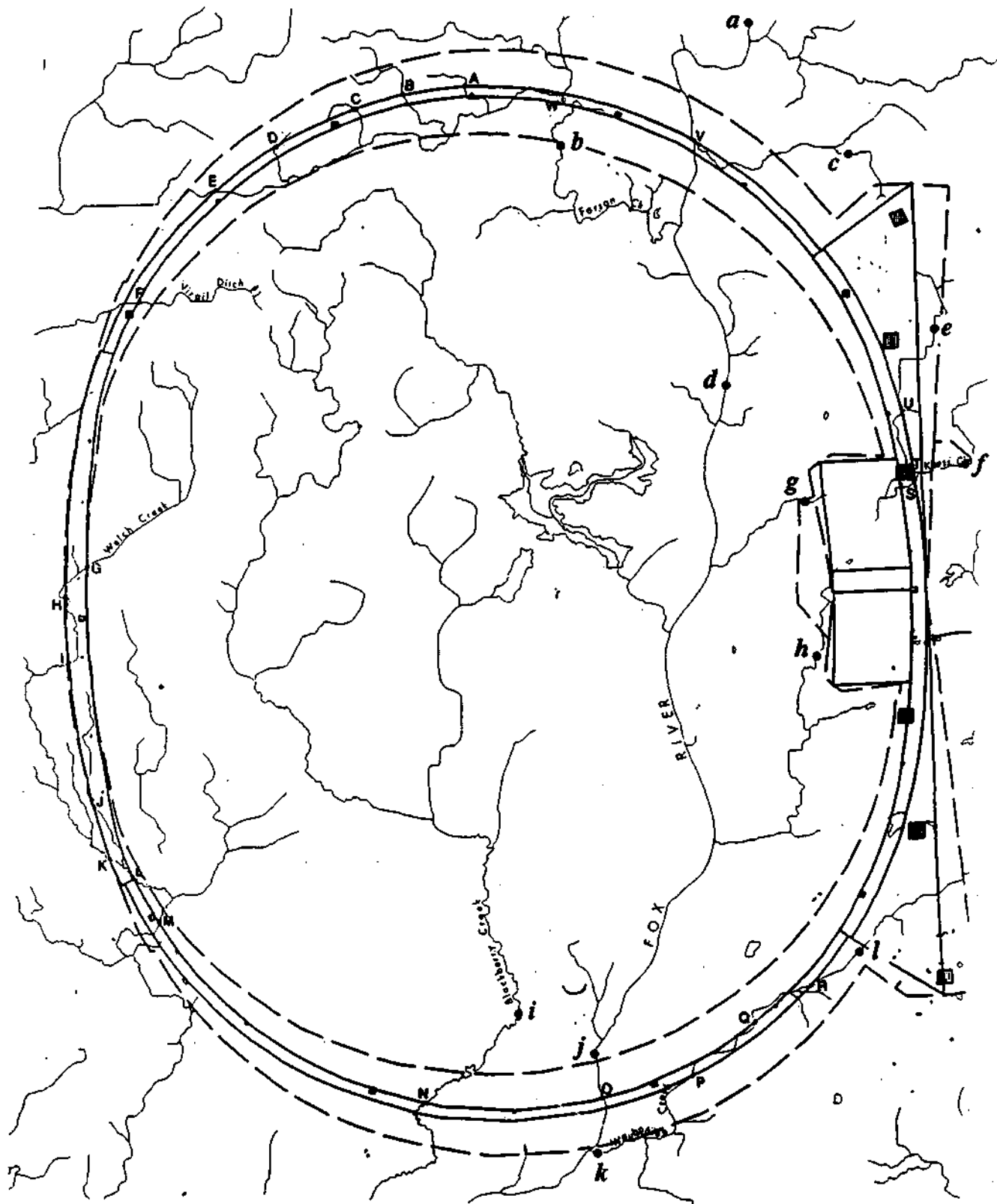


Figure 3. Intersections of area streams with proposed SSC ring layout and locations of approved 100-year flood flows

Table 1. Estimated Flow-Parameter Values at Selected Locations  
for Streams in the SSC Ring Area

<i>ID</i>	<i>Stream</i>	<i>Location</i>	<i>Drainage area (sq mi)</i>	<i>Channel length (mi)</i>	<i>Estimated flow-parameter values (cfs)</i>			
					<i>Q<sub>2</sub></i>	<i>Q<sub>25</sub></i>	<i>Q<sub>50</sub></i>	<i>Q<sub>100</sub></i>
A	Trib to Ferson Ck.	T40N R7E S12	0.41	0.86	23.1	54.1	61.1	68.5
B	Trib to Ferson Ck.	T40N R7E S11	1.33	2.19	46.2	99.0	110.7	122.4
C	Trib to Ferson Ck.	T40N R7E S10	0.82	0.78	52.1	<b>146.8</b>	170.9	195.7
D	Trib to Ferson Ck.	T40N R7E S17	1.08	1.05	58.4	<b>156.5</b>	180.9	205.8
E	Trib to Ferson Ck.	T40N R7E S19	0.18	0.57	12.2	27.8	31.3	35.0
F	Virgil Ditch #1	T40N R6E S36	2.90	2.51	99.0	238.5	271.8	304.7
G	Welch Creek	T39N R6E S23	9.91	3.98	282.0	747.8	866.3	980.8
H	Welch Creek	T39N R6E S27	12.07	4.92	306.0	783.3	903.0	1017.6
I	Welch Creek	T39N R6E S34	13.59	6.57	290.4	686.1	781.6	872.0
J	Trib to Welch Creek	T38N R6E S11	1.33	2.57	41.8	84.4	93.6	102.8
K	Welch Creek	T38N R6E S14	19.92	12.11	300.1	615.4	686.7	752.5
L	Welch Creek	T38N R6E S23	22.12	13.08	320.5	653.5	728.7	797.8
M	Welch Creek	T38N R6E S25	37.37	14.76	525.4	1147.3	1293.8	1427.4
N	Blackberry Creek	T37N R7E S10	64.51	26.97	652.2	1284.4	1427.3	1553.7
O	Fox River	T37N R8E S8	1737.88	138.29	5460.0	12200.0	13800.0	15300.0
P	Waubansee Creek	T37N R8E S10	20.28	9.46	357.2	804.8	910.9	1009.8
Q	Waubansee Creek	T37N R8E S2	18.44	7.80	363.5	861.1	981.8	1095.3
R	Waubansee Creek	T38N R8E S36	9.39	6.39	197.7	435.9	491.0	543.5
S	Trib to Kress Creek	T38N R9E S17	3.57	3.08	109.1	255.2	289.6	323.4
T	Kress Creek	T39N R9E S17	12.55	5.08	312.9	798.4	919.9	1036.2
U	Kress Creek	T39N R9E S8	10.09	3.78	297.0	805.7	936.6	1063.3
V	Fox River	T40N R8E S15	1592.21	119.60	4450.0	9560.0	10700.0	11800.0
W	Ferson Creek	T40N R8E S8	45.33	8.40	922.4	2580.6	3021.4	3435.7

Note: Flow-parameter values were not estimated from regression equations since these are not applicable to the main Fox River. The values given are estimated from the historical flow records for the Fox River at Algonquin and at Dayton.

Table 2. Selected Sites in the Vicinity of the SSC Ring  
whose Approved 100-Year Flood Flows are in the Repository

<i>ID</i>	<i>Stream/Site</i>	<i>Drainage area (8q mi)</i>	<i>Stream mile (from mouth)</i>	<i>Q<sub>100</sub> (cf8)</i>
a	Fox River South Elgin	1556	67.2	11319
b	Ferson Creek 3700' south of Bolcum Road	46.6	5.0	3720
c	Norton Creek Kane-DuPage County Line	5.26	3.2	360
d	Fox River Geneva	1653	57.9	12250
e	Kress Creek Hawthorne Lane	4.2	6.4	505
f	Kress Creek Town Road	1.48	2.0	1000
g	Mahonne Creek below Kirk Road	0.83	2.2	125
h	Indian Creek Highway 56	5.24	6.0	680
i	Blackberry Creek Kane-Kendall County Line	59.6	11.3	1750
j	Fox River Aurora	1705	49.3	14368
k	Waubansee Creek Mouth	29.6	0.0	2007
l	Waubansee Creek Kane-DuPage County Line	9.41	7.2	849



## DISCUSSION

The map of hydrologic features in the study region, like other GIS maps of sensitive areas, was a valuable tool in site evaluation for the SSC. While the geometry of the proposed ring was still being discussed, a variety of arrangements were sketched and overlaid on maps of environmental features to ascertain the number and severity of conflicts that might be caused by each arrangement. Once the size and shape of the ring had been chosen, that configuration was superimposed on the floodplain map and moved within allowable limits to minimize potential conflicts. The chosen configuration was compared to other GIS maps of sensitive areas, and the potential impacts of its location were considered relative to those data sets. On these bases, the site plan was ultimately developed to meet all the requirements of the SSC while minimizing the aggregate effect of conflicts with environmental features.

By that time, the urgency of the issue of floodplain conflicts had become somewhat diminished for three reasons. First, the SSC was to be built in a tunnel excavated in bedrock several hundred feet below the land surface. Therefore the construction of surface facilities would not have been required along the entire circumference of the ring, but only at about 30 small sites in addition to the research campuses on the east and west sides. Second, additional latitude was allowed in the location of surface facilities, so that any single site could be moved several hundred feet from the spot shown on the optimal ring configuration without creating any difficulty. Finally, any facility whose location in a floodplain was unavoidable could still be designed to win construction approval by meeting permit requirements of floodplain management ordinances. At this point, then, it was clear that judicious site selection, careful compilation of data on hydrologic features, and confidence in engineering design capability had removed floodplain considerations from the list of possible stumbling blocks for the SSC.

The floodplain map for the study region was a useful planning product in its own right. It was the first map of the area to show floodplain extent without regard for corporate boundaries. In creating this map, the ISWS also attempted to remedy some of the defects common to the FEMA maps. The USGS 7.5-minute topographic map is the usual starting point for study-area identification in an FIS, and more detailed topographic maps at greater resolution are often used to improve the accuracy of the floodplain delineation.

Nevertheless, the FIRMs have several weaknesses from a geographic standpoint. The map legends of the FIRMs are approximate only. The concentration of detailed information around a stream in an FIS generally results in a good depiction of the stream and the floodplain immediately surrounding it. But an FIS often shows a poor representation of the streets and areas farther from the stream or between streams. Some roads on the FIRMs are shown according to design plans that existed at the time of the FIS, rather than as they were actually constructed. Some have never been built. This occasionally causes a stream location between

streets to be shown improperly. Finally, in many cases different levels of effort were applied to individual streams between communities or between a community and a county.

The end result is that even if all FIRMs for the study region had been enlarged or reduced to a common scale, they could not have been successfully combined into a useful planning document without extensive corrections to mappings of streams, floodplains, roads, and corporate limits. In fairness to FEMA, it should be stated that the FIRMs are intended to serve as local resources to aid in identifying whether individual properties lie inside or outside a special flood-hazard area. For this application, the FIRMs perform quite adequately. They were not intended for use as regional planning tools. Furthermore, the FIRMs are intended to represent the flood profile, which is the critical product of the FIS in FEMA's view, and no claims are made for geographic accuracy.

The work done by ISWS to compile the FIRMs into a floodplain map for the study region addressed some of their weaknesses. Using the USGS 7.5-minute topographic maps as a base guaranteed a better geographic representation in the final product. A considerable amount of engineering judgment was used in mapping floodplains, especially at corporate limits, because consistency was sought both across the boundaries and with the USGS topography. The GIS coverage that resulted from this effort was a good rendition of the FIRMs on a geographic base that was consistent with other GIS products. Nevertheless, there were limitations in this process. As previously stated, the smallest floodplain width that could be shown on the ISWS product was 200 feet. Many FIRMs purport to show floodplain widths as small as 25 feet. Also, the fact that the ISWS work was done at a scale of 1:24,000 means that its accuracy in the immediate vicinity of a stream that was studied in detail is probably less than that of the FIRM. However, for its specific application in site evaluation for the SSC, the ISWS map performed perfectly.

To illustrate the foregoing explanations, the GIS floodplain coverage was plotted for ten townships in the study region at scales corresponding to those of the FIRMs covering their areas. The GIS plots were then laid over the FIRMs of the same scale and examined for their effectiveness in representing the FIRMs. Selected segments of these products appear in figures 4 through 15. Paired figures appear on facing pages: the segment of the GIS plot is on the left page, and the segment of the corresponding FIRM is on the right page. Following are the areas represented by the six pairs of figures:

<i>Section</i>	<i>Township</i>	<i>FIRM and Panel</i>	<i>Scale</i>
3,4,9, 10,15,16	Virgil (40N.6E)	Kane County #125	1:24000
12	Campton (40N.7E)	Kane County #45	1:12000
17	Oswego (37N,8E)	Oswego #5	1:9600
27,34	Winfield (39N,9E)	Warrenville #1	1:7200
15,22	Dundee (42N,8E)	Carpentersville #1	1:6000
10	Batavia (39N,8E)	Geneva #2	1:4800

The FIRMs show section lines, streamlines, floodplain boundaries, roads, and railroads. The GIS plots show only the first three items, since roads and railroads already exist in separate GIS coverage based on USGS topographic maps. They were not redigitized for the floodplain coverage. The GIS plots show section boundaries as broken lines, stream centerlines as heavy lines, and floodplain boundaries as conventional lines; floodplains were not shaded.

Before reviewing the pairs of figures, a few general comments should be made. A gap measuring 0.1 inch on a map with a scale of 1:24,000 represents a distance of 200 feet; the same gap on a map with a scale of 1:4,800 represents a distance of 40 feet. Therefore, any comparison based on reviewing overlaid maps must give consideration to the scaling factor. Also, when a FIRM illustrates a detailed study on a stream and shows flood elevations in 1-foot increments, the shape of its floodplain is almost certainly superior to that on the GIS plot. The latter was developed by placing those elevations on USGS topography with 10-foot contour intervals. But the FIRM was probably plotted on 1-foot or 2-foot topographies. On the other hand, the GIS plots should be favored over the FIRMs in any depiction of section and township lines. Brief comments follow on each of the six pairs of figures:

*Figures 4 and 5, Virgil Township, scale 1:24,000:* The two figures match perfectly throughout because they were mapped in essentially the same manner on topographic base maps of the the same scale. The only appreciable differences are that the GIS plot omits some depressional storage areas that are not connected to streams but that are shown as flood-hazard areas on the FIRMs.

*Figures 6 and 7, Campton Township, scale 1:12,000:* Again the matching between the two figures is quite good, although gaps of 0.1 inch (100 feet) are evident in some locations. A large parcel of slightly higher ground straddling Denker Road is excluded from the floodplain shown on the FIRM but included on the GIS plot.

*Figures 8 and 9, Oswego Township, scale 1:9,600:* The GIS plot, with its continuous presentation of floodplain without regard to corporate limits, is preferable to the FIRM for the village of Oswego. Differences between lines appear to be no more than about 0.15 inch (120 feet).

*Figures 10 and 11, Winfield Township, scale 1:7,200:* Floodplain shapes are different, mainly because the FIRM for the city of Warrenville shows more detail. However, the north-south orientations and distances between streams are also quite different, due to better geographic referencing of the GIS plot. Some gaps between the lines are as great as 0.4 inch (240 feet).

*Figures 12 and 13, Dundee Township, scale 2:6,000:* Once again, the detailed study and topographic mapping of the FIRM for the village of Carpentersville provide better floodplain shape than does the GIS plot. Floodplains on the GIS figure match those on the FIRM better when flooded areas are large and flood elevation changes are gradual. The maximum gaps of 0.25 inch represent a distance of 125 feet.

*Figures 14 and 15, Batavia Township, scale 1:4,800:* The floodplain shapes compare well between the two figures for the city of Geneva, but their orientation is not good. The apparently large gaps measuring 0.3 inch correspond to a distance of 120 feet.

It is clear from these comparisons that the floodplain coverage produced for the SSC study region could not be used without modification for local determinations of flood hazards on individual properties. It is also evident, however, that not all the differences between the GIS plots and the FIRMs are due to the procedures used to develop the GIS coverage. These comparisons have highlighted some of the problems inherent in the FIRMs.

## **SUMMARY**

Two flood-related products created by the ISWS to assist in the process of site evaluation for the SSC have both current and future value. The map of hydrologic features in the 36-township study region is the only comprehensive map of floodplains for the area. While it would not be appropriate to use the map for local flood-hazard determinations or regulatory purposes, it remains a useful tool for any sort of regional planning in the vicinity. Its creation has also helped to underscore some fundamental problems with the FIRMs used in local floodplain management. The 100-year flood flows calculated for the points of intersection between area streams and the SSC ring are, in most cases, the only values yet produced for the streams. They will be helpful starting points for detailed studies on the streams that must be undertaken in the very near future, according to the mandates of newly revised floodplain development ordinances.

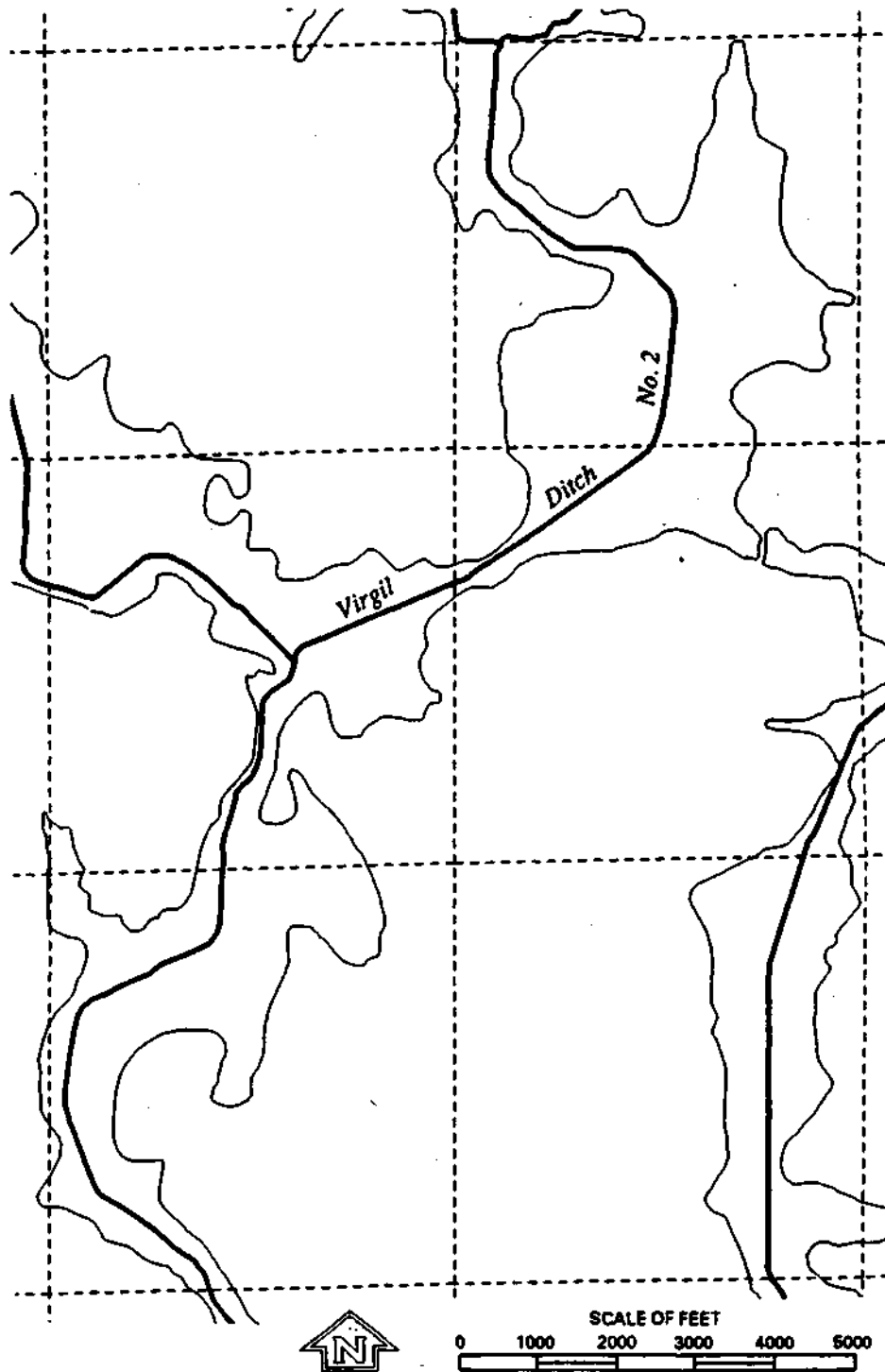


Figure 4. GIS floodplain coverage for Virgil Township, Kane County

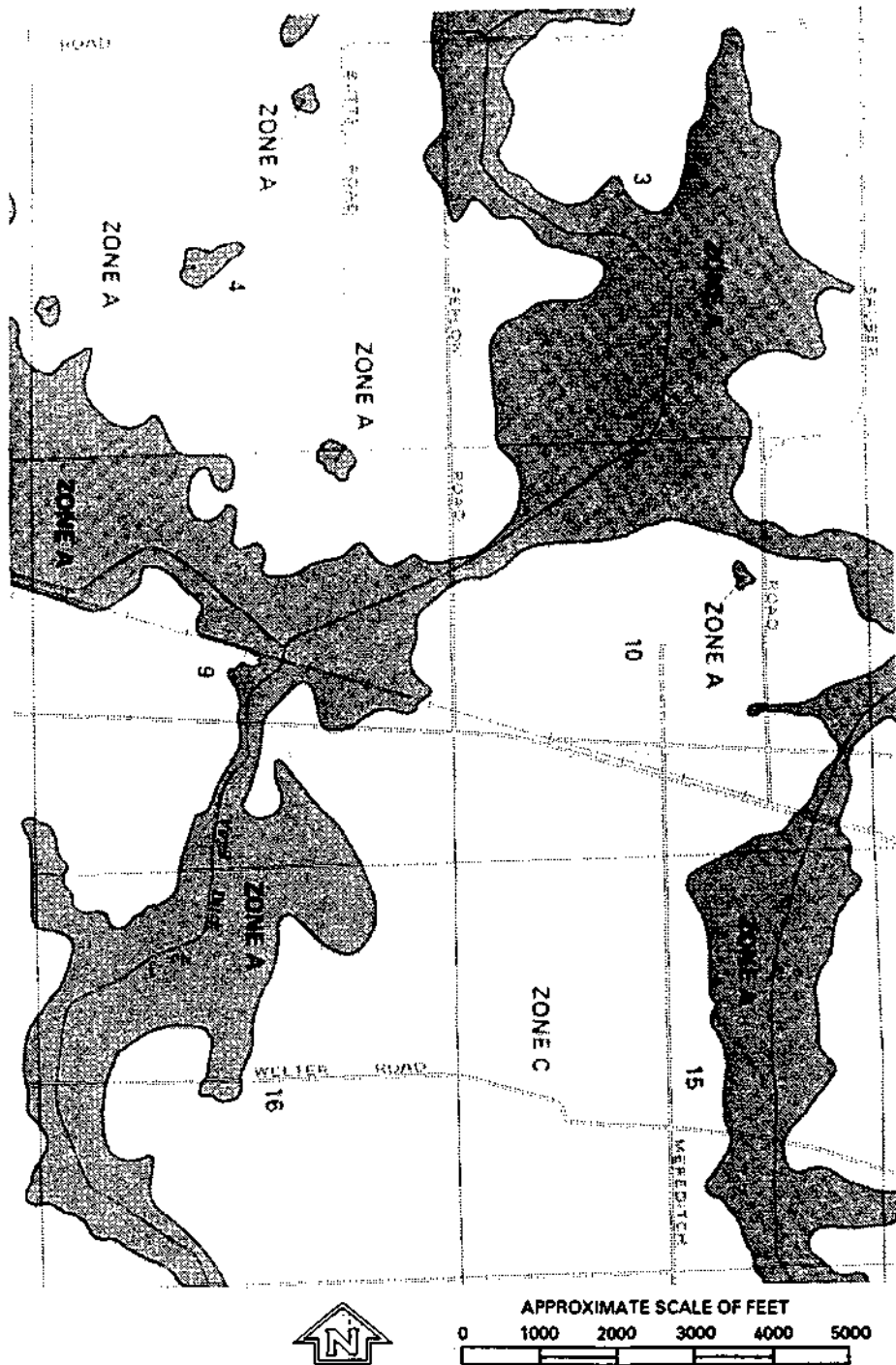


Figure 5. FEMA floodplain map for Virgil Township - Kane County FIRM

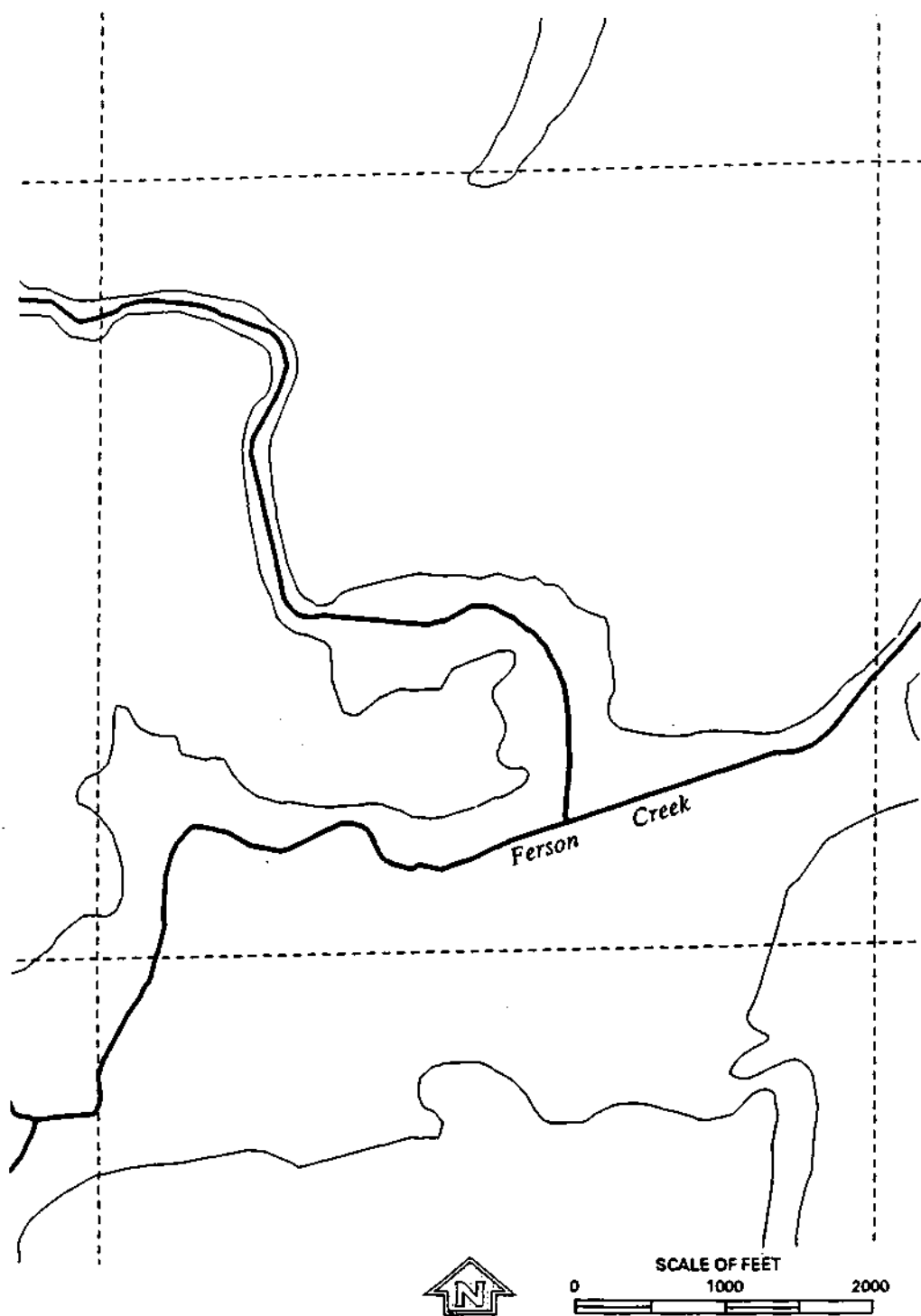


Figure 6. GIS floodplain coverage for Campton Township, Kane County



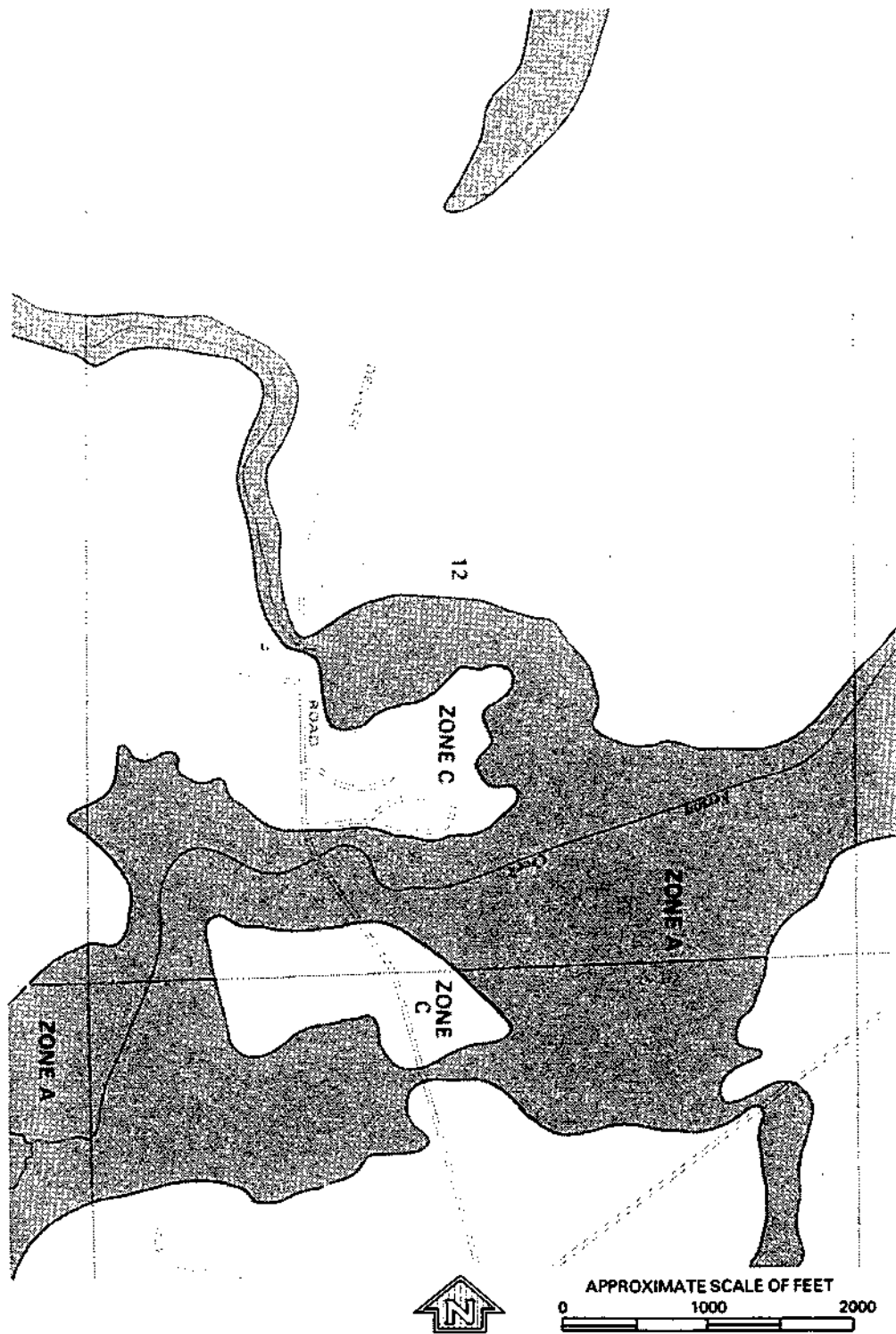


Figure 7. FEMA floodplain map for Campton Township - Kane County FIRM

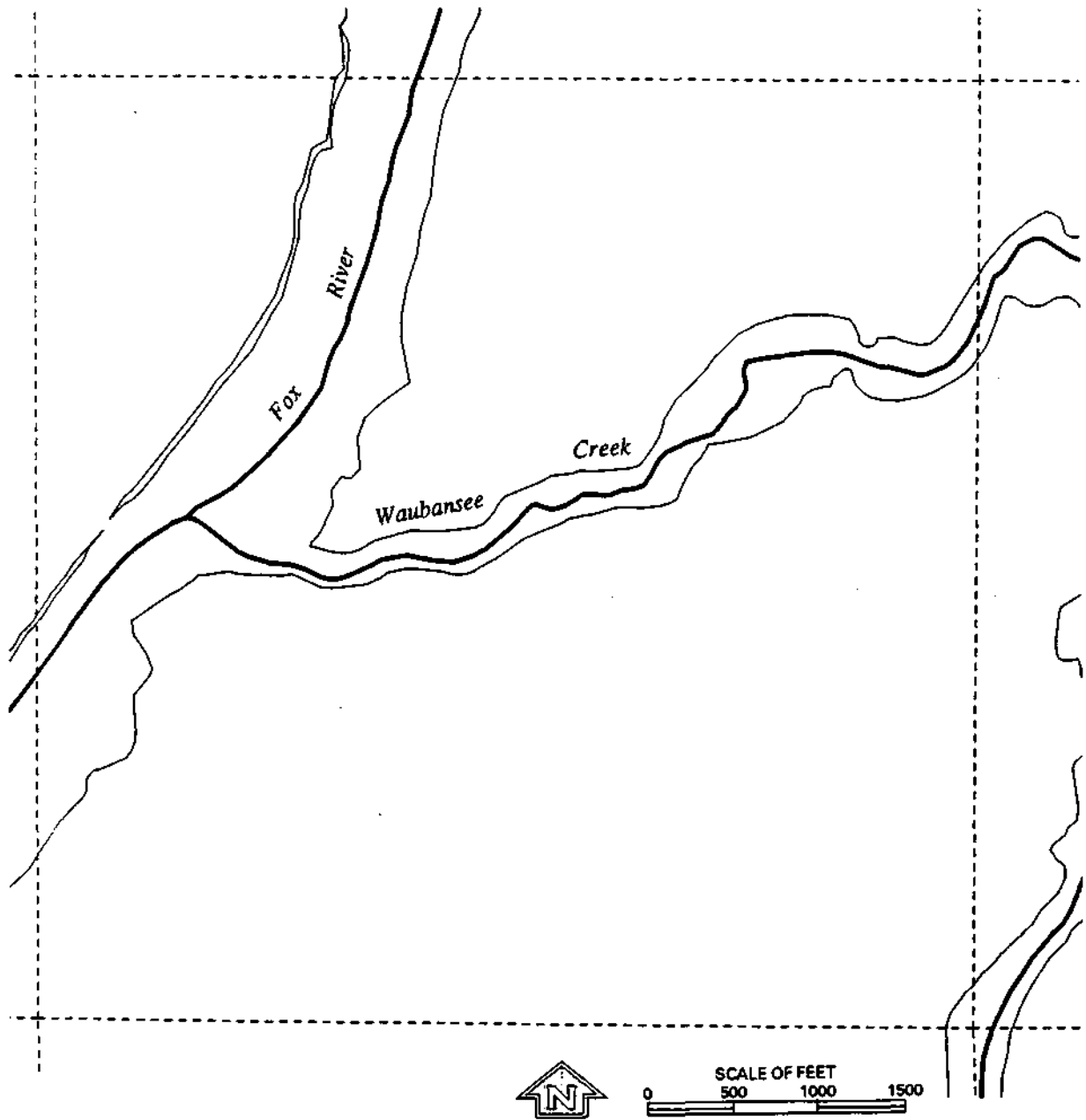


Figure 8. GIS floodplain coverage for Oswego Township, Kendall County

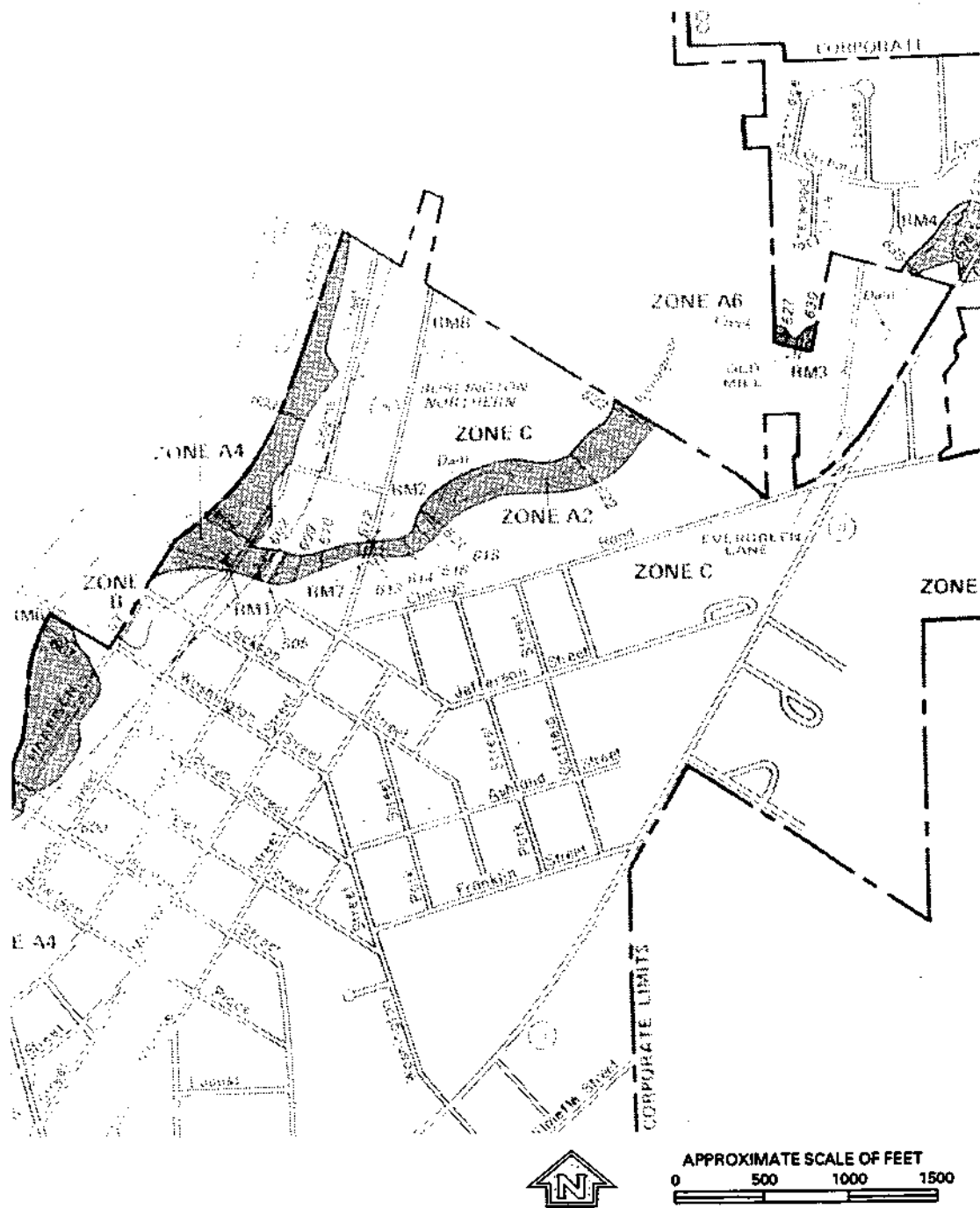


Figure 9. FEMA floodplain map for Oswego Township - Village of Oswego FIRM

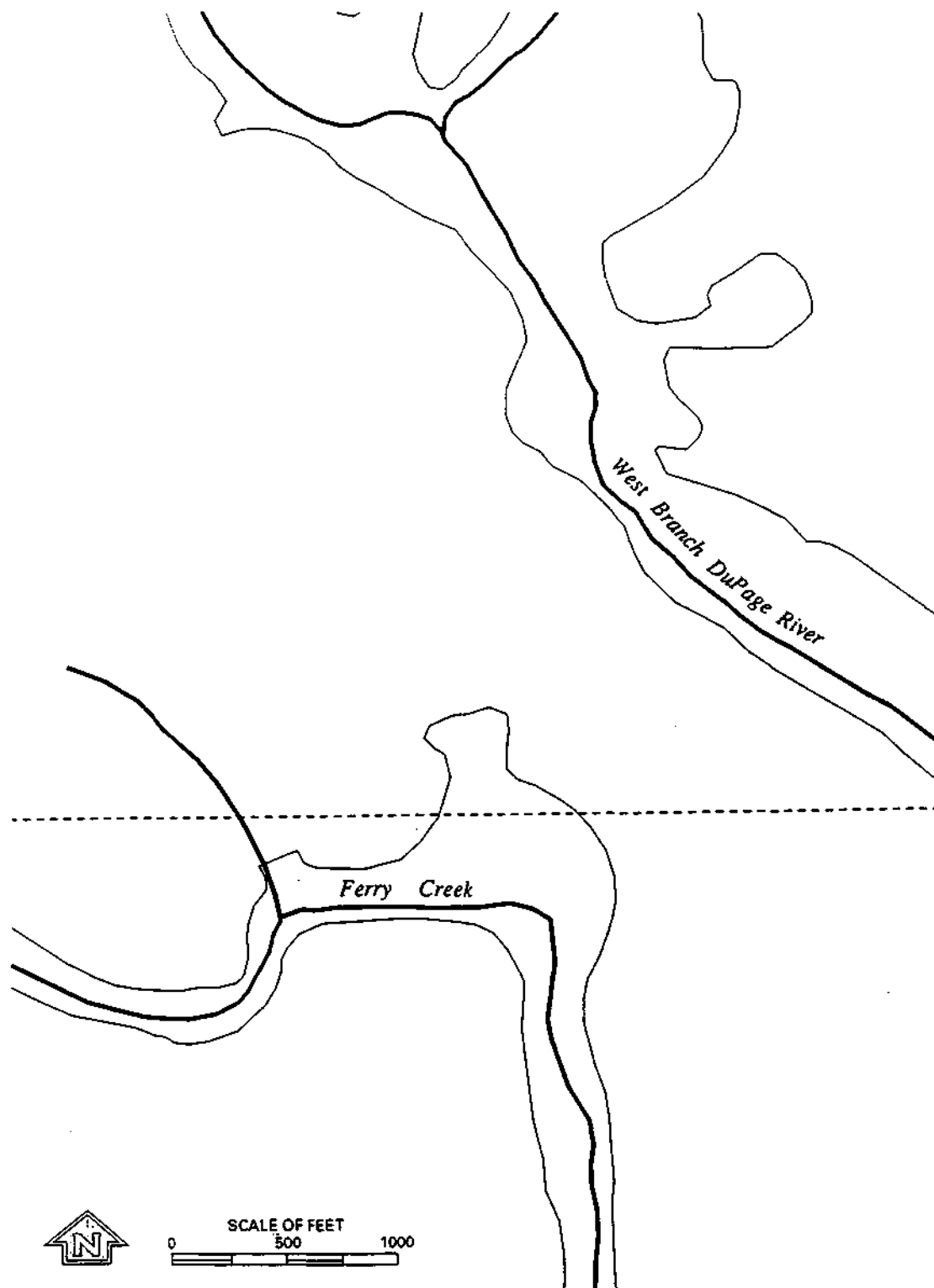


Figure 10. GIS floodplain coverage for Winfield Township, DuPage County



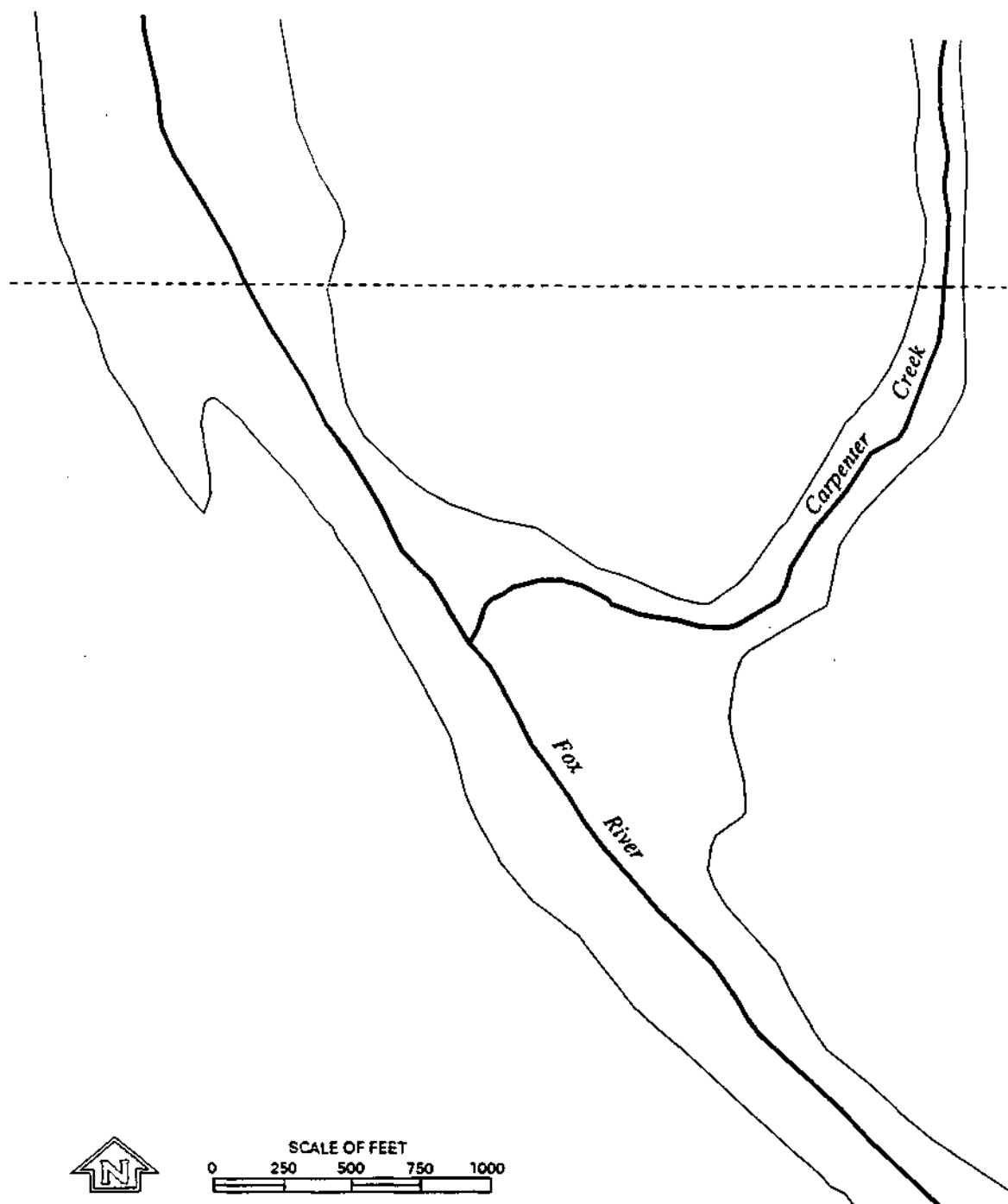


Figure 12. GIS floodplain coverage for Dundee Township, Kane County



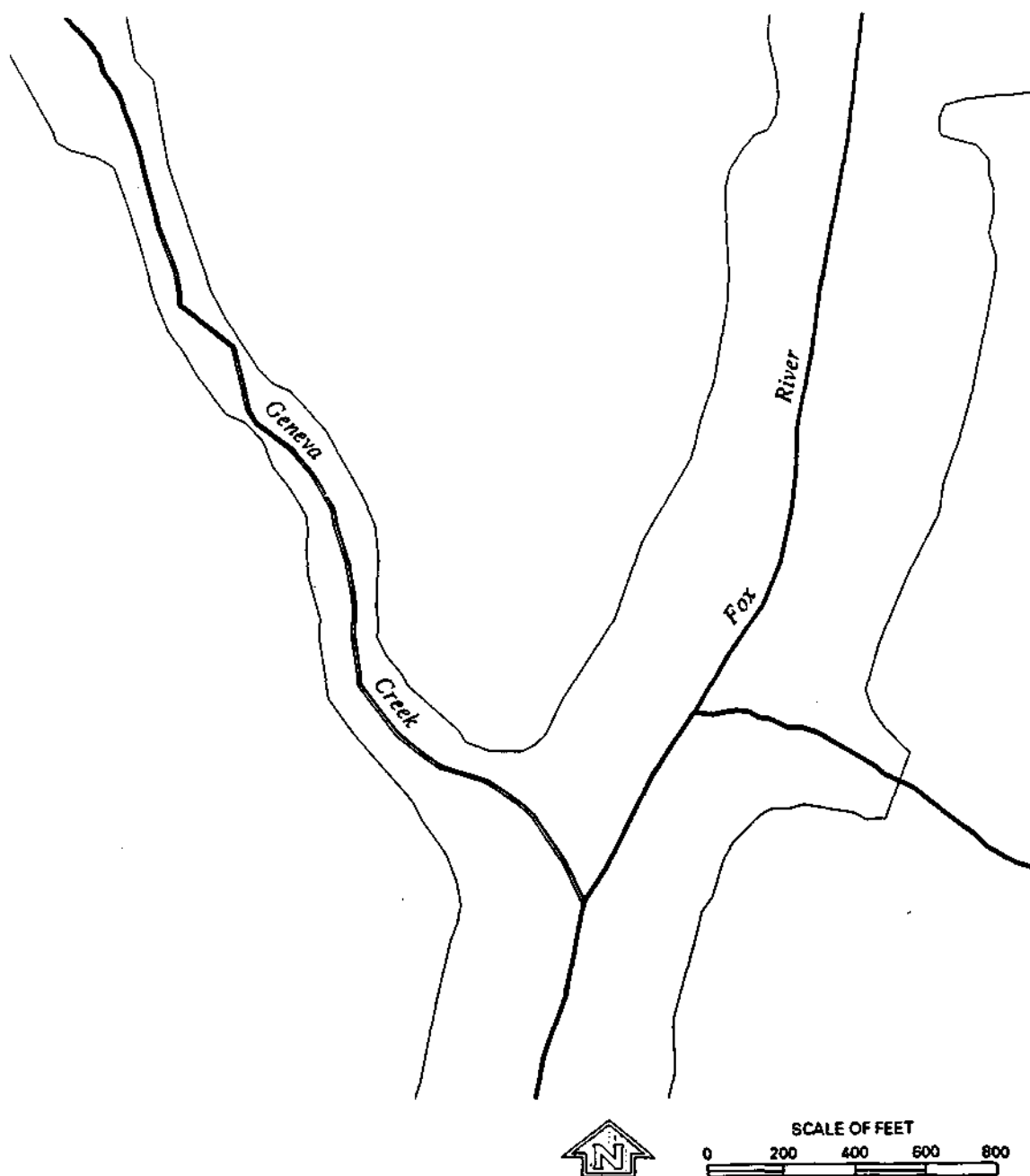


Figure 14. GIS floodplain coverage for Batavia Township, Kane County



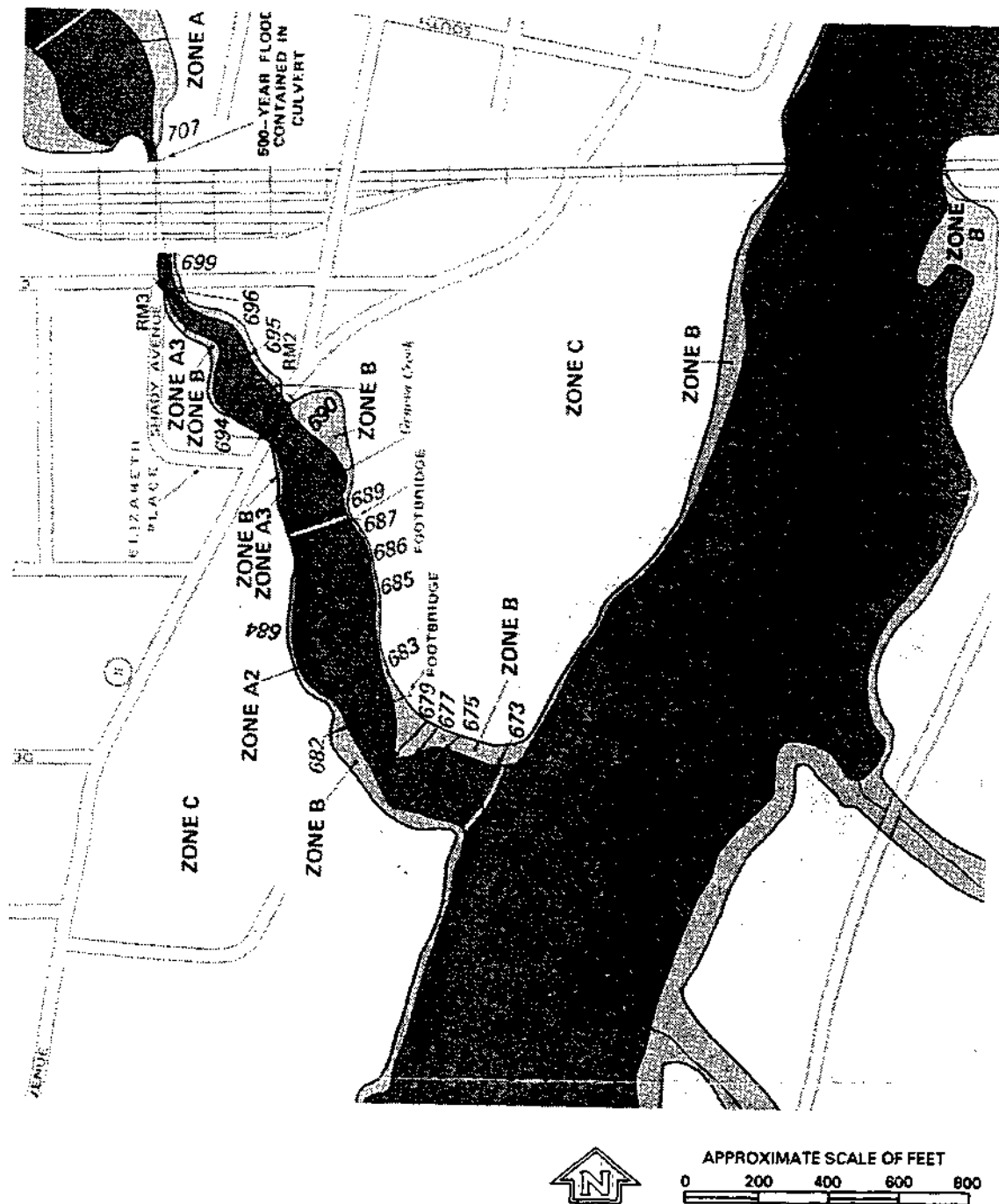


Figure 15. FEMA floodplain map for Batavia Township - City of Geneva FIRM